Responses to comments from referee #1

Summary: In this study, a regional configuration of the Barents Sea modeling system composed of ROMS and CICE 5.1.2 is used to study the impact of the assimilation of swath AMSR2 sea ice concentration data versus daily means of SIRANO sea ice concentration data. Particular focus was given to sub-regions with the 2.5km domain for the Barents and Greenland Sea. Two sets of atmospheric forcing are used to introduce ensemble spread: 1) Integrated Forecast System developed at ECMWF which provided members 1-5, and MET-AA which provided member 6. The EnKF is used as the data assimilation system in this study. Three experiments are performed: 1) Control run without DA, 2) synchronous assimilation using SIRANO data, and 3) asynchronous assimilation using AMSR2 swath data. This study found that the assimilation of the swath AMSR2 sea ice concentration led to a 10% improvement in the MAD at the end of the assimilation period and 7% improvement at the end of the 7-day forecast period.

This is a very thorough and well written paper. I only have minor comments listed below. I recommend publication.

Response: We thank the reviewer for the positive feedback and comments on the manuscript. Following the comments and suggestions, we provide answers and point out the modifications performed in the manuscript below.

General Comments:

Line 304: Rephrase “As CICE does not…” to something like “While CICE 5.1.2 used in this study does not differentiate between stationary ice attached to land, CICE6 includes a landfast ice parameterization (https://zenodo.org/record/7419531).

Response: We have clarified in the text that this applies to the CICE version used in this study and not to all CICE versions. Text added in Line 304, “As the CICE version used in this study does not differentiate between stationary ice attached to land and ice that is floating freely, the FI of the ice-charts maps is considered as VCDI in the validation.”

Fig. 5: Why was this particular month chosen (April 2022), with the Easter Holiday occurring mid-April? You lose data for 5 days (April 14-18) versus the typical 2 days on weekends? Since you should have the SIRANO data, I suggest you add that information for the Barents, Greenland, and Entire region to the plot.

Response: Yes, we agree that having the Easter holiday within the period of study was not beneficial for the ice-chart comparison. Initially, the period of study was chosen to be on the same time as an oceanographic cruise that took place in April 2022 in case we wanted to compare with the collected in-situ measurements. However, the measurements were too sparse in order to have a meaningful comparison with our experiments. As the most critical period for the ice-chart validation is the 7-day forecast, during which there were no holidays, we decided to keep April as the study period. Figure 5d's objective is to show the ice-classes maps from

SIRANO and ice-charts used in the validation presented in Section 4.3. SIRANO ice-classes map data was not added in the figure for the periods where ice-charts are not available to avoid confusion on what data was used in the validation. As SIRANO time series are already shown in Fig.6a-b, we rather keep Fig. 5 as it is.

Figure 9 caption: "Mean Absolute Difference" is defined as Mean Absolute Deviation on line 166. Please make correction.

Response: changed to "Mean Absolute Deviation".

Lines 443-450: Do you have any graphics or tables to support your (29% lower), (14.3% improvement) statements?

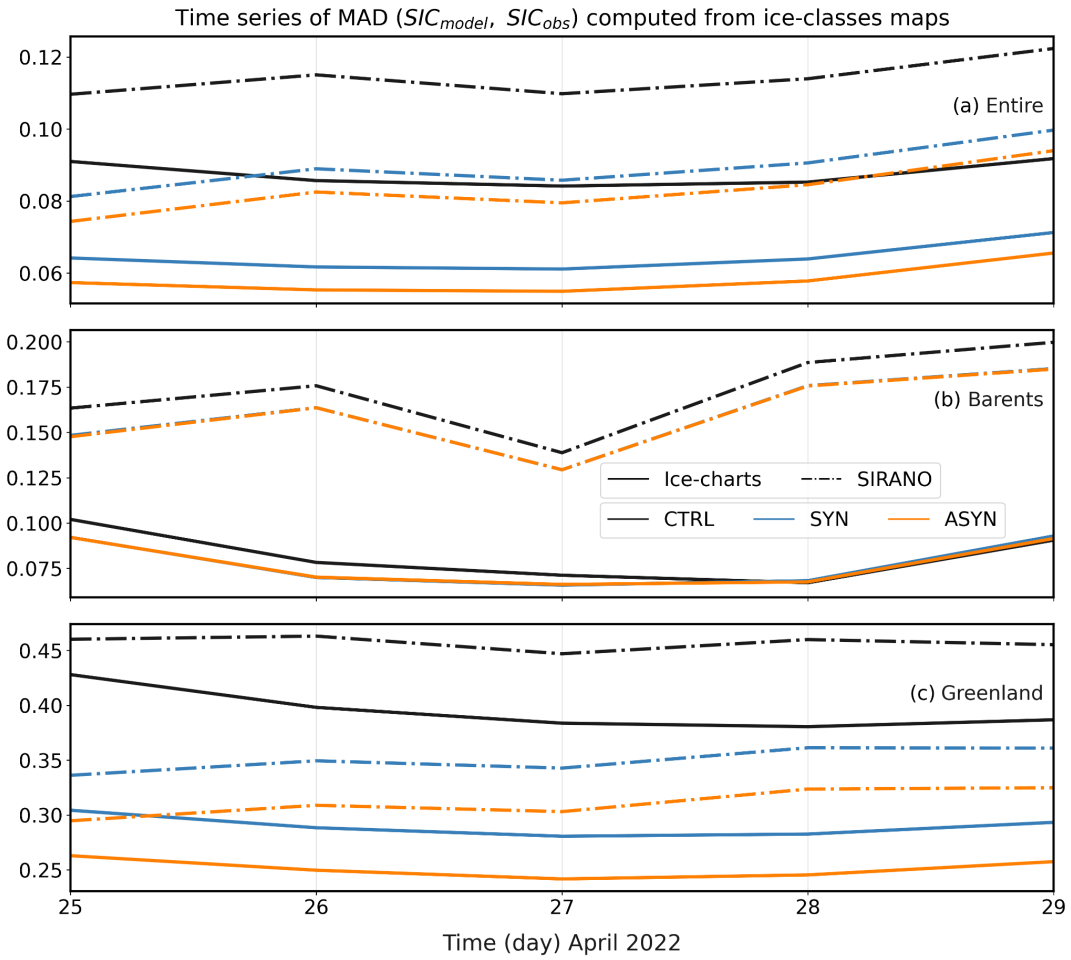

Fig R1. Time series of MAD computed between ice-charts (solid) and SIRANO (dash-dotted) and model ice-classes maps in the (a) entire, (b) Barents and (c) Greenland regions during the forecast period.

Response: The MADs are computed from SIRANO and ice-chart ice-classes maps and model data. The time series of MADs during the 7-day forecast period is shown in Figure R1 for the entire region, and Barents and Greenland subregions. On average, the ice-chart time series for

the entire region presents a 29% lower MAD than the SIRANO time-series. Regarding the ice-charts time series, ASYN shows an improvement of 12.2% compared to the SYN experiment at the end of the 7-day forecast period in the Greenland region (MAD_{SYN}=0.2933, MAD_{ASYN}=0.2575). In contrast, the ASYN improvement is much weaker (1.5%) at the end of the forecast period in the Barents region (MAD_{SYN}=0.0929, MAD_{ASYN}=0.0915). These two numbers have been updated in the manuscript as previous numbers (14.3%, 2.1%) corresponded to the end of the assimilation period instead of the forecast period. Figure R1 has been added to the Appendix of the manuscript in order to clarify the origin of these computed values.